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Elasticity of NaMgF3 at High Pressure and Temperature

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Introduction: The perovskite structure is of the form ABX_3. It consists of corner-sharing B-X octahedra that house A cations in 12-fold coordination. Interest in this unique structure stems, in part, from a central role in Earth Science: Ferroelastic phase transitions in the perovskite $MgSiO_3$ may explain observed seismic discontinuities in Earth's lower mantle [Shim and Jeanloz 2002]. NaMgF3 is orthorhombic and isostructural to MgSiO3 thus, it may be used as a proxy for determining structural behavior at extreme conditions [O'Keeffe 1979].

NaMgF3 was shown to undergo a phase transition from orthorhombic to cubic at elevated pressure and temperature [Zhao et al. 1994]. It is our interest to characterize the seismic signature of NaMgF3 at deep earth conditions as it transforms from orthorhombic to cubic symmetry.

Methods and Materials: The polycrystalline sample of NaMgF3 was prepared in air using conventional solid-state methods. Data collection was performed in energy-dispersive mode. Details of the experimental setup can be found elsewhere [Li and Liebermann 2000].

Results: The velocity of both P and S waves propagating through NaMgF3 were recorded to 9 GPa and 1000 Degrees C using a 'saw-tooth' P/T path. In contrast to previous work, our NaMgF3 sample did not reach the cubic phase transition at 1000 degrees C until pressure was released as far as ~.7 GPa instead of the predicted value of 5.2 GPa. This discrepancy may have been a result of poor grain averaging in the sample.

Conclusions: More analysis is needed to determine the exact affect of pressure and temperature on the elasticity of NaMgF3.

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